

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 3

The listing of the claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Please cancel claims 10-69.

1. (Original) A positive displacement sorter apparatus, comprising:
 - means for defining a plurality of slats, said slats being interconnected thereby defining an endless web, an upper run of said web defining a conveying surface;
 - means for defining a plurality of pusher shoes, said pusher shoes gliding along at least some of said slats to laterally displace articles on said conveying surface;
 - secondary means for defining a plurality of linear motor secondaries at said slats;
 - primary means for producing thrust in said secondaries and thereby propelling said web;
 - and
 - control means for controlling said primary means.
2. (Original) The sorter apparatus of claim 1 including support means for supporting the web, said support means including wheels at some of said slats rotating about an axis projecting from an interior of the associated slats and a track network for supporting said wheels.
3. (Original) The sorter apparatus of claim 1 wherein each of said slats has an upper surface portion that is substantially planar.
4. (Original) The sorter apparatus of claim 1 wherein each of said slats has an outer surface at or below said conveying surface for all orientations of said slats.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 4

5. (Original) The sorter apparatus of claim 1 wherein said primary and secondary means are chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

6. (Original) The sorter apparatus of claim 1 wherein said primary means are between upper and lower runs of said web.

7. (Original) The sorter apparatus of claim 1 wherein said secondary means include magnet plates in interiors of said slats.

8. (Original) The sorter apparatus of claim 1 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein at least a portion of said primary means are adjacent an upper run of said web for propelling slats in said upper run, said primary means being positioned where said diverter assemblies are not positioned.

9. (Original) The sorter apparatus of claim 1 wherein at least a portion of said primary means is adjacent a lower run of said web for propelling slats in said lower run from above, wherein said primary means produce sufficient thrust to propel said web without elevating said slats in said lower run.

10. – 69. (Cancelled)

70. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web having upper and lower portions and transition portions between said upper and lower portions, said upper portion of said web defining a conveying surface, pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

a support track network having upper and lower track portions and transition track portions between said upper and lower track portions;

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
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Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 5

a wheel assembly moveably supporting said endless web for movement on said support track network; and

at least one of said support track network having top and bottom portions and a transition track portion between said top and bottom portions, said transition track portion having a support surface that is a non-circular curve in side elevation.

71. (Original) The sorter apparatus of claim 70 wherein said support surface is substantially non-symmetrical about a horizontal axis.

72. (Original) The sorter apparatus of claim 71 wherein said support surface has one of a generally larger radius of curvature above said horizontal axis than below said horizontal axis or a generally larger radius of curvature below said horizontal axis than above said horizontal axis.

73. (Original) The sorter apparatus of claim 70 wherein said support surface is substantially symmetrical about a horizontal axis.

74. (Original) The sorter apparatus of claim 70 wherein at least one of said transition track portions comprises a moveable portion to accommodate expansion and contraction of said web including an expansion joint between said moveable portions and the remainder of said support track network to provide track network continuity between said moveable portion and said remainder of said support track and a force-producing member applying a force on said moveable portion.

75. (Original) The sorter apparatus of claim 74 wherein said force-producing member produces a substantially constant force irrespective of position of said moveable portion.

76. (Original) The sorter apparatus of claim 70 including a linear motor propulsion system for said web.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
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For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 6

77. (Original) The sorter apparatus of claim 76 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

78. (Original) The sorter apparatus of claim 76 wherein said propulsion system comprises at least one motor primary adjacent said web and a plurality of motor secondaries with said slats.

79. (Original) The sorter apparatus of claim 78 wherein said at least one motor primary is between upper and lower runs of said web.

80. (Original) The sorter apparatus of claim 78 wherein said motor secondaries include magnet plates in said slats.

81. (Original) The sorter apparatus of claim 78 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

82. (Original) The sorter apparatus of claim 78 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

83. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web having upper and lower portions and transition portions between said upper and lower portions, said upper portion of said web defining a conveying surface;

pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 7

a support track network;

a wheel assembly moveably supporting said endless web for movement on said support track network; and

said support track network including a stationary portion, a moveable portion to accommodate expansion and contraction of said web, and at least one expansion joint between said stationary and moveable portions to provide track network continuity between said stationary and moveable portions.

84. (Original) The sorter apparatus of claim 83 wherein said at least one expansion joint comprises a plurality of interlaced fingers.

85. (Original) The sorter apparatus of claim 83 including a force-producing member applying a force on said moveable portion.

86. (Original) The sorter apparatus of claim 85 wherein said force-producing member produces a substantially constant force irrespective of position of said moveable portion.

87. (Original) The sorter apparatus of claim 83 wherein said moveable portion is generally horizontally moveable.

88. (Original) The sorter apparatus of claim 83 including a linear motor propulsion system for said web.

89. (Original) The sorter apparatus of claim 88 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

90. (Original) The sorter apparatus of claim 88 wherein said propulsion system comprises at least one motor primary adjacent said web and a plurality of motor secondaries with said slats.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 8

91. (Original) The sorter apparatus of claim 88 wherein said at least one motor primary is between upper and lower runs of said web.

92. (Original) The sorter apparatus of claim 90 wherein said motor secondaries include magnet plates in said slats.

93. (Original) The sorter apparatus of claim 90 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

94. (Original) The sorter apparatus of claim 90 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

95. (Original) A positive displacement sorter apparatus, comprising:

- a plurality of interconnected slats defining an endless web having upper and lower portions and transition portions between said upper and lower portions, said upper portion of said web defining a conveying surface;

- pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

- a support track network;

- a wheel assembly moveably supporting said endless web for movement on said support track network; and

- said support track network including a stationary portion, a moveable portion and a force-producing member, movement of said moveable portion with respect to said stationary portion accommodating expansion and contraction of said web, said force-producing member

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 9

applying a substantially constant force on said moveable portion irrespective of position of said moveable portion.

96. (Original) The sorter apparatus of claim 95 wherein said force-producing member applies a substantially horizontal force on said moveable portion.

97. (Original) The sorter apparatus of claim 95 wherein said force-producing member comprises a weight assembly and a cable system for translating gravitational force produced by said weight assembly to an outwardly directed force on said moveable portion.

98. (Original) The sorter apparatus of claim 97 wherein said force-producing member applies a substantially horizontal force on said moveable portion.

99. (Original) The sorter apparatus of claim 97 wherein said weight assembly has a mass that is adjustable.

100. (Original) The sorter apparatus of claim 97 including an expansion joint between said moveable portion and said stationary portion.

101. (Original) The sorter apparatus of claim 95 including a linear motor propulsion system for said web.

102. (Original) The sorter apparatus of claim 101 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

103. (Original) The sorter apparatus of claim 101 wherein said propulsion system comprises at least one motor primary adjacent said web and a plurality of motor secondaries with said slats.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 10

104. (Original) The sorter apparatus of claim 103 wherein said at least one motor primary is between upper and lower runs of said web.

105. (Original) The sorter apparatus of claim 103 wherein said motor secondaries include magnet plates in said slats.

106. (Original) The sorter apparatus of claim 103 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

107. (Original) The sorter apparatus of claim 103 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

108. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web having upper and lower portions and transition portions between said upper and lower portions, said upper portion of said web defining a conveying surface;

pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

a support track network;

a wheel assembly moveably supporting said endless web for movement on said support track network;

a plurality of diverters and associated diverter rails for selectively displacing ones of said pusher shoes laterally of said conveying surface to displace articles on said conveying surface;
and

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 11

a frame for supporting said support track network, said diverters and diverter rails, said frame comprising at least two longitudinal horizontal members, said horizontal members defining fastener channels along said horizontal members wherein said diverters and diverter rails can be selectively mounted at chosen positions along said frame by fasteners engaging said fastener channels.

109. (Original) The sorter apparatus of claim 108 wherein said horizontal members comprise extruded members.

110. (Original) The sorter apparatus of claim 108 wherein said frame includes support legs and wherein said support legs are selectively mounted at chosen positions along said frame by fasteners engaging said fastener channels.

111. (Original) The sorter apparatus of claim 108 including a plurality of cross braces between said horizontal members, said cross braces are selectively mounted at chosen positions along said frame by fasteners engaging said fastener channels.

112. (Original) The sorter apparatus of claim 108 including a linear motor propulsion system for said web.

113. (Original) The sorter apparatus of claim 112 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

114. (Original) The sorter apparatus of claim 112 wherein said propulsion system comprises at least one motor primary adjacent said web and a plurality of motor secondaries with said slats.

115. (Original) The sorter apparatus of claim 114 wherein said at least one motor primary is between upper and lower runs of said web.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 12

116. (Original) The sorter apparatus of claim 114 wherein said motor secondaries include magnet plates in said slats.

117. (Original) The sorter apparatus of claim 114 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

118. (Original) The sorter apparatus of claim 114 wherein said at least one motor primary is selectively mounted at a chosen position along said frame by fasteners engaging said fastener channels.

119. (Original) The sorter apparatus of claim 114 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

120. (Original) The sorter apparatus of claim 119 wherein said at least one motor primary is selectively mounted at a chosen position along said frame by fasteners engaging said fastener channels.

121. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web, an upper portion of said web defining a conveying surface;

pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface; and

a closed-loop propulsion system for said endless web, said propulsion system comprising at least one motor, a web sensor for sensing movement of said web and a control that is

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 13

responsive to said web sensor to excite said at least one motor in a manner that reduces speed fluctuations resulting from variations in article loading of said endless web.

122. (Original) The sorter apparatus of claim 121 wherein said web sensor comprises a slat sensor.

123. (Original) The sorter apparatus of claim 122 wherein said web sensor comprises a sensor chosen from a proximity sensor, an optical sensor, an ultrasonic sensor and a microwave sensor.

124. (Original) The sorter apparatus of claim 122 wherein said web sensor identifies transitions between slats.

125. (Original) The sorter apparatus of claim 122 wherein said web sensor further identifies at least one particular slat.

126. (Original) The sorter apparatus of claim 125 wherein said web sensor includes at least one Hall-effect sensor and said at least one particular slat includes at least one magnet, wherein said web sensor identifies said at least one particular slat by identifying said at least one magnet with said at least one Hall-effect sensor.

127. (Original) The sorter apparatus in claim 125 wherein said web sensor identifies multiple particular slats.

128. (Original) The sorter apparatus of claim 121 wherein said propulsion system comprises a linear motor propulsion system and wherein said at least one motor comprises at least one linear motor primary and a plurality of motor secondaries with said slats.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 14

129. (Original) The sorter apparatus of claim 128 wherein said at least one linear motor primary comprises a plurality of linear motor primaries and wherein said control excites said plurality of linear motor primaries in a manner that reduces said plurality of linear motor speed fluctuations resulting from variations in article loading of said endless web.

130. (Original) The sorter apparatus of claim 129 wherein said control supplies digital signals to said plurality of linear motor primaries to excite said plurality of linear motor primaries.

131. (Original) The sorter apparatus of claim 130 wherein said linear motor primaries comprise an analog voltage-controlled variable frequency drive and a coil supplied by said variable frequency drive and wherein said control comprises a microcontroller and digital-to-analog converters at said variable frequency drives.

132. (Original) The sorter apparatus of claim 128 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

133. (Original) The sorter apparatus of claim 128 wherein said at least one motor primary is between upper and lower runs of said web.

134. (Original) The sorter apparatus of claim 128 wherein said motor secondaries include magnet plates in said slats.

135. (Original) The sorter apparatus of claim 128 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 15

136. (Original) The sorter apparatus of claim 128 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

137. (Original) The sorter apparatus of claim 128 wherein said propulsion system includes an idle speed mode in which said web is propelled at a reduced speed when articles are not being provided to said conveying surface.

138. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web having upper and lower runs and transition portions between said upper and lower runs, said upper run of said web defining a conveying surface;

pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface; and

a linear motor propulsion system for propelling said web, said propulsion system comprising at least one motor primary adjacent said web and a plurality of motor secondaries with said slats, said at least one motor primary propelling slat in said lower run from above, said linear motor propulsion system configured to produce sufficient thrust to propel said web without substantially elevating said slats in said lower run.

139. (Original) The sorter apparatus of claim 138 including a support track network and a wheel assembly moveably supporting the endless web for movement on the support track network, wherein said support track network supports said lower run from below said slats.

140. (Original) The sorter apparatus of claim 139 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, and at least one other motor primary propelling slat in said upper portion from below said slats in said upper portion, said at least one other motor primary being positioned where said diverter assemblies are not positioned.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 16

141. (Original) The sorter apparatus of claim 138 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

142. (Original) The sorter apparatus of claim 138 wherein said motor secondaries include magnet plates in said slats.

143. (Original) The sorter apparatus of claim 142 wherein said magnet plates are fixed from within the associated slats.

144. (Original) The sorter apparatus of claim 143 wherein said motor magnet plates are fixed from within the associated slats by at least one chosen from interference fit, inserts and adhesive.

145. (Original) A positive displacement sorter apparatus, comprising:

a plurality of interconnected slats defining an endless web, an upper run of said web defining a conveying surface;

pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

a linear motor propulsion system for propelling said web, said linear motor propulsion system comprising at least one motor primary and a plurality of motor secondaries, including magnet plates in said slats; and

wherein said magnet plates are retained in the associated slats by being fixed from within the associated slats.

146. (Original) The sorter apparatus of claim 145 wherein said magnet plates are fixed from within the associated slats by interference fit between said motor magnet plates and the associated slats.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 17

147. (Original) The sorter apparatus of claim 145 wherein said magnet plates are fixed from within the associated slats by deforming portions of the slats.

148. (Original) The sorter apparatus of claim 145 wherein said magnet plates are fixed from within the associated slats by inserts between at least one of the magnet plates and the corresponding slat.

149. (Original) The sorter apparatus of claim 145 wherein said magnet plates are fixed from within the associated slats by at least one of an adhesive and welding.

150. (Original) The sorter apparatus of claim 145 wherein said slats are extruded,

151. (Original) The sorter apparatus of claim 150 including pockets in said slats for said magnet plates.

152. (Original) The sorter apparatus of claim 145 including a plurality of magnet plates in each of said slats.

153. (Original) The sorter apparatus of claim 145 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

154. (Original) The sorter apparatus of claim 145 wherein said at least one motor primary is between upper and lower runs of said web.

155. (Original) The sorter apparatus of claim 145 including a plurality of diverter assemblies to selectively laterally divert said pusher shoes, wherein said at least one motor primary is adjacent an upper run of said web and is adapted to propel slats in said upper run, said at least one motor primary being positioned where said diverter assemblies are not positioned.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 18

156. (Original) The sorter apparatus of claim 145 wherein said at least one motor primary is adjacent a lower run of said web and is adapted to propel slats in said lower run from above, wherein said at least one motor primary is configured to produce sufficient thrust to propel said web without elevating said slats in said lower run.

157. (Original) A method of sorting articles, comprising:

- providing a plurality of interconnected slats defining an endless web, an upper portion of said web defining a conveying surface;

- providing pusher shoes gliding along at least some of said plurality of slats to laterally displace articles on said conveying surface;

- providing a web sensor and sensing movement of said web with said web sensor;

- providing a propulsion system comprising at least one motor; and

- exciting said at least one motor at least as a function of an output of said web sensor, thereby reducing speed fluctuations resulting from variations in article loading of said endless web.

158. (Original) The method of claim 157 wherein said web sensor comprises a slat sensor.

159. (Original) The method of claim 158 wherein said web sensor comprises a sensor chosen from a proximity sensor, an optical sensor, an ultrasonic sensor, and a microwave sensor.

160. (Original) The method of claim 158 including identifying transitions between slats with said proximity sensor.

161. (Original) The method of claim 158 including identifying at least one particular slat with said web sensor.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 19

162. (Original) The method of claim 161 wherein said web sensor includes a Hall-effect sensor and said at least one particular slat includes a magnet, wherein said identifying said at least one particular slat includes identifying said magnet with said Hall-effect sensor.

163. (Original) The method of claim 157 wherein said propulsion system comprises a linear motor propulsion system and wherein said at least one motor comprises at least one linear motor primary and a plurality of motor secondaries with said slats.

164. (Original) The method of claim 163 wherein said at least one linear motor primary comprises a plurality of linear motor primaries and further including exciting the plurality of linear motor primaries as a function of said output of said web sensor.

165. (Original) The method of claim 164 wherein said exciting the plurality of linear motor primaries may include supplying digital signals to said plurality of linear motor primaries and adjusting said linear motor primaries with said digital signals.

166. (Original) The method of claim 163 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

167. (Original) The method of claim 163 including providing said at least one motor primary between upper and lower runs of said web.

168. (Original) The method of claim 163 including providing magnet plates in said slats.

169. (Original) The method of claim 163 including providing a plurality of diverter assemblies and selectively laterally diverting said pusher shoes with said diverter assemblies, and providing said at least one motor primary adjacent an upper run of said web positioned where said diverter assemblies are not positioned and propelling slats in said upper run with said at least one motor primary.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 20

170. (Original) The method of claim 163 including providing said at least one motor primary adjacent a lower run of said web and propelling slats in said lower run from above with said at least one motor primary including producing sufficient thrust to propel said web without elevating said slats in said lower run.

171. (Original) The method of claim 163 including propelling said web at a reduced speed when articles are not being provided to said conveying surface.

172. (Original) A method of sorting articles, comprising:

- providing a plurality of interconnected slats defining an endless web having upper and lower runs and transition portions between said upper and lower runs, said upper run of said web defining a conveying surface;

- providing pusher shoes gliding along at least some of said plurality of slats;

- providing a linear motor propulsion system for propelling said web, said propulsion system comprising at least one motor primary adjacent said web and a plurality of motor secondaries with said slats;

- propelling slats in said lower run from above with said at least one motor primary, including producing sufficient thrust to propel said web without substantially elevating said slats in said lower run; and

- laterally displacing articles on said conveying surface with said pusher shoes.

173. (Original) The method of claim 172 including providing at least one other motor primary and propelling slats in said upper run with said other motor primary from below.

174. (Original) The method of claim 172 including providing a plurality of diverter assemblies to selectively laterally divert said pusher shoes and providing said at least one other motor primary being positioned where said diverter assemblies are not positioned.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 21

175. (Original) The method of claim 172 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

176. (Original) The method of claim 172 including providing magnet plates in said slats.

177. (Original) The method of claim 176 including fixing said magnet plates from within the associated slats.

178. (Original) The method of claim 177 including fixing said magnet plates from within the associated slats by at least one chosen from interference fit, inserts, adhesive and welding.

179. (Original) A method of sorting articles, comprising:

providing a plurality of interconnected slats defining an endless web having upper and lower runs and transition portions between said upper and lower runs, said upper run of said web defining a conveying surface;

providing pusher shoes gliding along at least some of said plurality of slats;

providing a linear motor propulsion system and propelling said web with said propulsion system, said linear motor propulsion system comprising at least one motor primary and a plurality of motor secondaries at said slats;

positioning said at least one motor primary being between said upper and lower runs and said plurality of motor secondaries at said slats; and

laterally displacing articles on said conveying surface with said pusher shoes.

180. (Original) The method of claim 179 wherein said linear motor propulsion system is chosen from one of a synchronous linear motor system and a non-synchronous linear motor system.

181. (Original) The method of claim 179 including providing a plurality of diverter assemblies to selectively laterally divert said pusher shoes and providing said at least one motor primary adjacent an upper run of said web positioned where said diverter assemblies are not positioned.

Applicants : Frank W. Veit, David W. Zeitler, PhD, Rhonda J. Verploegen,
Andrew R. Black, Charles W. Bozarth and
Clyde Miin-Arng Ko
For : POSITIVE DISPLACEMENT SHOE AND SLAT SORTER
APPARATUS AND METHOD
: Preliminary Amendment
Page : 22

182. (Original) The method of claim 179 including fixing magnet plates from within the associated slats.

183. (Original) The method of claim 182 including fixing said magnet plates from within the associated slats by at least one chosen from interference fit, inserts, adhesive and welding.

184. (Original) The method of claim 179 including providing said at least one motor primary to propel slats in said lower run from above.

185. (Original) The method of claim 183 including producing sufficient thrust with said at least one motor primary to propel said web without elevating said slats in said lower portion.

186. (Original) The method of claim 179 including providing a plurality of diverter assemblies to selectively laterally divert said pusher shoes, and providing another motor primary that is adjacent an upper run of said web propelling slats in said upper run from below.

187. (Original) The method of claim 186 including providing said another motor primary positioned where said diverter assemblies are not positioned.